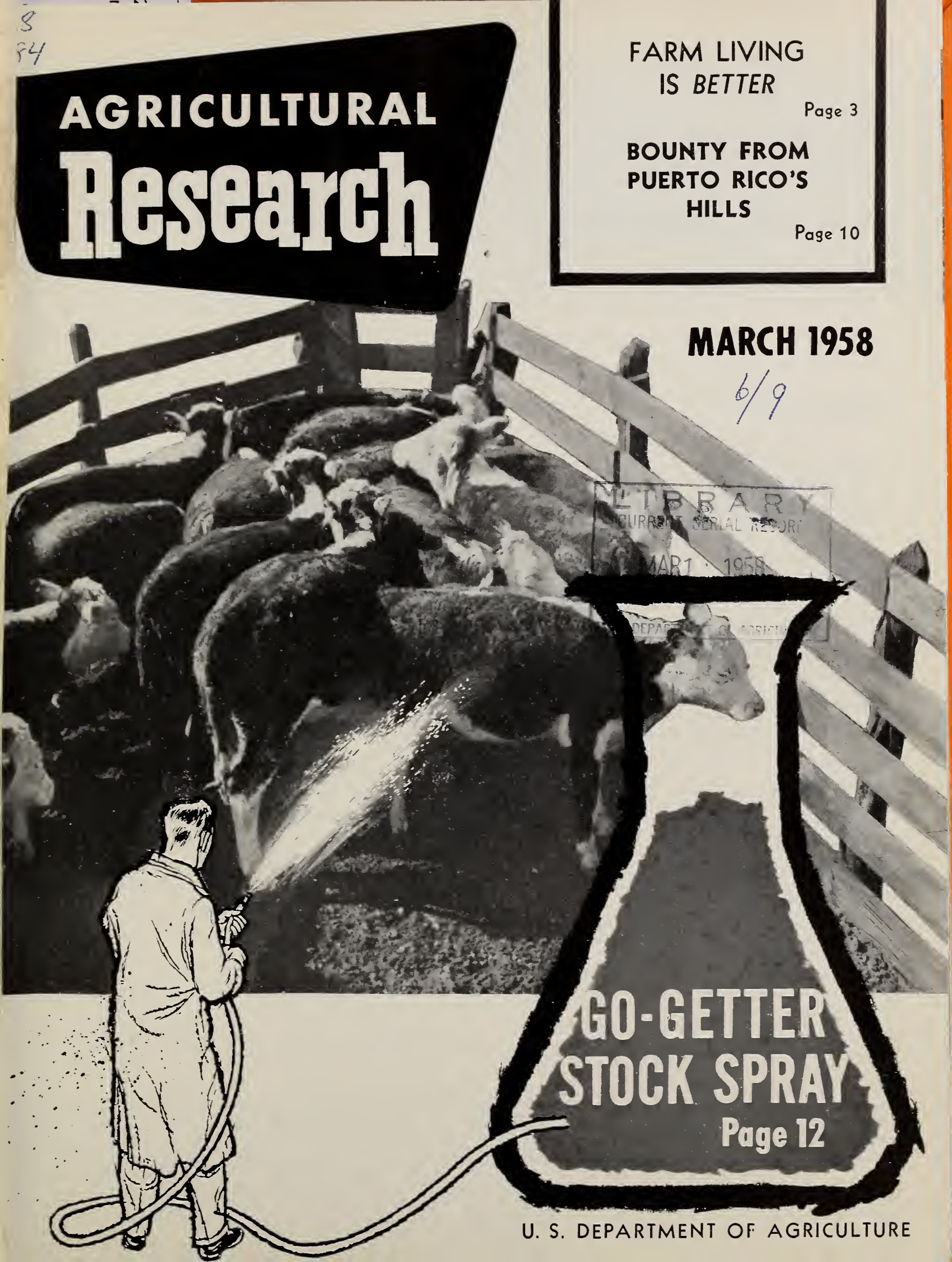
AGRICULTURAL Research

MARCH 1958



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CONTENTS

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Eradicate

One of the big scientific accomplishments of this century is our ability to wipe out major crop and livestock pests.

Why is *eradication* the first thought when a new pest hits us? Because our people have seen this approach work.

It started with the successful fight opened against pleuropneumonia of cattle in 1884. Over the years, we've knocked out the cattle fever tick, cattle scabies, dourine and glanders of horses, fowl plague, the fatal Asiatic form of Newcastle disease of poultry, and foot-and-mouth disease. The plant pest record is equally outstanding: Mediterranean fruit fly, parlatoria date scale, citrus blackfly, and citrus canker.

Naturally, we do our best to keep pests out of the country by quarantines at our ports. It's better to keep pests out than to try to fight them. But if one does slip through, it's better to eradicate the pest than to control it. And if we lack the experience or research for eradication, it's better to control the pest for the time being than to let it spread.

More and more, we're able to deal with these pests before they become widespread agricultural threats. That's because our tools are the best ever and are constantly being improved. Research is giving us new methods and materials (and there could hardly be too much research against pests that cost the American economy $9 *billion* a year!). Close working relationships between State and Federal agencies, and between government and industry, are sharpening our efforts.

So we're always *thinking* eradication. This means almost day-to-day reappraisal of old pest problems in terms of new information. We are now pushing eradication campaigns against a dozen new and old insects and diseases such as the khapra beetle, gypsy moth, fire ant, vesicular exanthema, brucellosis, and tuberculosis. In addition, we are making efforts to control another dozen pests such as the pink bollworm, white-fringed beetle, European chafer, and blue tongue of sheep.

Our immediate goal is to maintain and advance the production efficiency of American farmers by reducing the losses from agricultural pests. Eventually, the stakes could be even higher—a battle between man and pests for survival.

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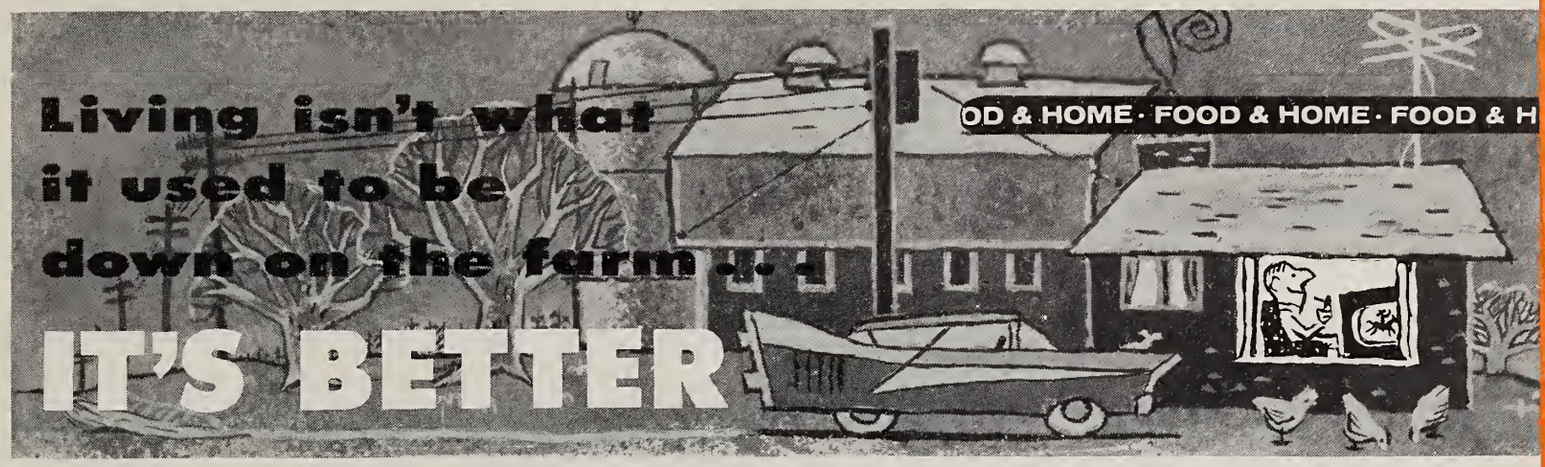


FARM FAMILIES HAVE MADE tremendous gains in levels of living since 1941. This shows up in all categories of family spending. More money is going for medical care, for modern equipment and labor-saving materials which give homemakers more leisure, and for improving homes for more comfortable, more pleasant living.

Findings by home economists in the USDA Institute of Home Economics, from a recent analysis of farm household expenditures, provide evidence of the gains. Data used for the analysis came chiefly from a survey in which nearly 4,000 farm-operator families living in all parts of the United States reported their 1955 expenditures, from a recent survey of urban family living expenditures, and from a survey of both farm and urban family living expenditures in 1941. These data were supplemented by information from the Bureau of the Census on housing facilities and equipment. The analysis was directed by ARS home economist Margaret L. Brew.

Families are spending more for living

Farm families spent about two-thirds more money in 1955 than in 1941, when dollar values are adjusted for price changes. Their spending in 1955 was about half that of city families. In 1941 it was only 30 percent as much. Rural levels of living are closer to urban spending than these figures indicate, however, because farm families usually have much home-produced food and usually don't pay separate rent for the farm dwelling.

Medical care made most gain and in this category farm families approached the closest to city levels of spending. Farm families spent an average of $235 in 1955, as compared with $155 spent in 1941 (calculated in 1955 prices). The 1955 level is about three-fourths that of city families.

One reason for the gain is the widespread growth of medical prepayment plans and health insurance. These enable families to procure and finance medical treatment when needed. Also, new hospitals built under the rural community health assistance program make medical care more readily available to farm families.

Almost impossible to measure is the improvement electric power and equipment brings to country living. The rapid spread of power lines is an indication of the value farm families put on power. In 1940 only 33 percent of farm households had electricity, 18 percent had piped running water, and 15 percent a mechanical refrigerator. By 1956, 94 percent of farm homes had electricity, 64 percent piped running water, and 90 percent a mechanical refrigerator. A goodly number had washing machines, telephones, indoor flush toilets, and other facilities and labor-saving equipment. How the use of electricity has increased is indicated by expenditures for current. In 1955 rural families spent, on the average, $81. In 1941, when the rate for electric current was higher, they spent only $39.

More farm families now purchase piped and bottled gas for cooking and fuel oil for heating and fewer buy wood, coal, and kerosene. That's just another evidence of how city conveniences are spreading to the farm.

Farm houses also are being improved. In 1955 farm families spent an average of $125 for repairs and remodeling. Work most frequently reported was painting, papering, and installation or repair of plumbing, awnings, screens, or storm windows. And more than twice as many families bought furniture in 1955 than in 1941.

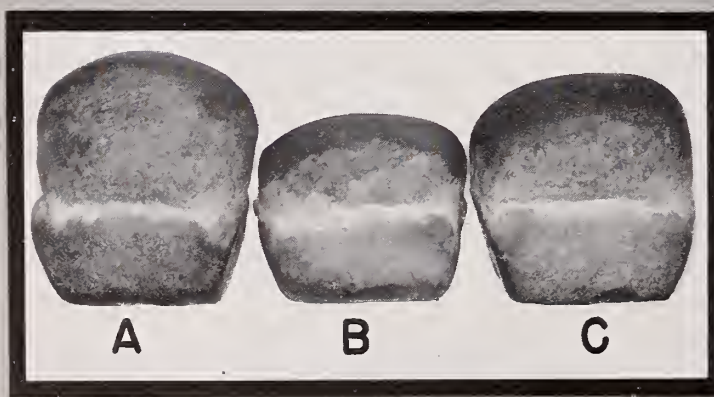
Television sets, not available in 1941, bring entertainment, education, and news of current events to farm families. In 1956, 53 percent of farm operators owned a television set; in April 1957, 63 percent had one.

Food buying pattern has changed somewhat

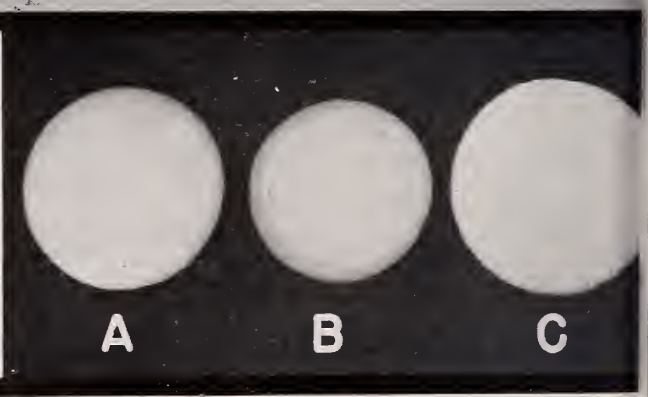
Food was one item which took the same percentage of the farm family dollar in 1955 as in 1941. The pattern of food spending, however, has changed. Farm families eat out more and, like city families, they buy more of the convenient processed or semiprocessed foods. Less food is home produced. This may result in families eating less of some important foods they used to produce, because it has been found that families use less when they buy food than when they produce it themselves. ☆

NEW

EXPERIMENTAL test baking is conducted under rigidly controlled conditions. Here, the USDA technician is passing the dough piece through standard sheeting rolls prior to molding into the final loaf form. After baking the volume of each of the loaves is measured to provide an accurate index of quality performance.



UNTREATED FLOUR gives normal-sized loaf of bread like loaf A. Removing all lipids damages the flour, as loaf B shows, even when the lipids are subsequently restored, as in loaf C. All three loaves had 3 percent shortening added.



COOKIES change when lipids are entirely removed from commercial cookie flour. A is from untreated flour; B from lipid-free flour; C from lipid-free flour to which lipids were restored. All cookies contain 12 percent shortening.

KEY TO FLOUR QUALITY

Little-understood class of chemicals is giving up some secrets that may help us improve our methods for making high-quality bakery goods

WE ARE AT LAST beginning to learn some things about flour that may lead to answers we've needed about its baking behavior. Lipids—those mysterious but important fat-like substances found in many foods—may yield valuable answers.

Lipids comprise only one and one-half percent of flour by weight. Yet they are important enough, according to recent investigations, to greatly affect flour quality, baking behavior, and storage stability. Their influence on flour can be good or bad.

Over the past 30 years, cereal chemists have suspected that lipids influence baking quality in some unexplained manner. Comprehensive, long-range research in progress under the leadership of chemists D. K. Mecham and J. W. Pence at USDA's Western Utilization Research and Development Division at Albany, Calif., is increasing our knowledge of lipid composition and the relation between lipids and other flour constituents.

Lipids in flours are of three types—*simple fats* (or triglycerides) similar to lard and refined vegetable oils; *compound lipids* such as glycolipids and phospholipids; and *derived lipids* such as fatty acids.

Identification of constituents, far from complete, is necessary in defining the role of each class of lipids. As a further complication, amount of lipids and proportion of the different types of lipids vary with the source of wheat as well as with age and treatment that the flour receives.

Systematic studies at Albany include methods for extracting lipids from the flour. Some lipids are loosely held—perhaps approaching a mechanical mixture—and can be easily removed by simple solvents. Some lipids are tightly bound to other flour components, particularly the proteins. Their removal involves special solvents and chemical treatments.

Lipids restored to flour

After removal, the lipids need to be separated into distinct fractions or individual compounds for further study. The properties of each fraction or compound then must be characterized alone and in conjunction with other flour components. Baking quality of flours from which all lipids have been extracted and then added back singly gives another indication of each lipid's contribution.

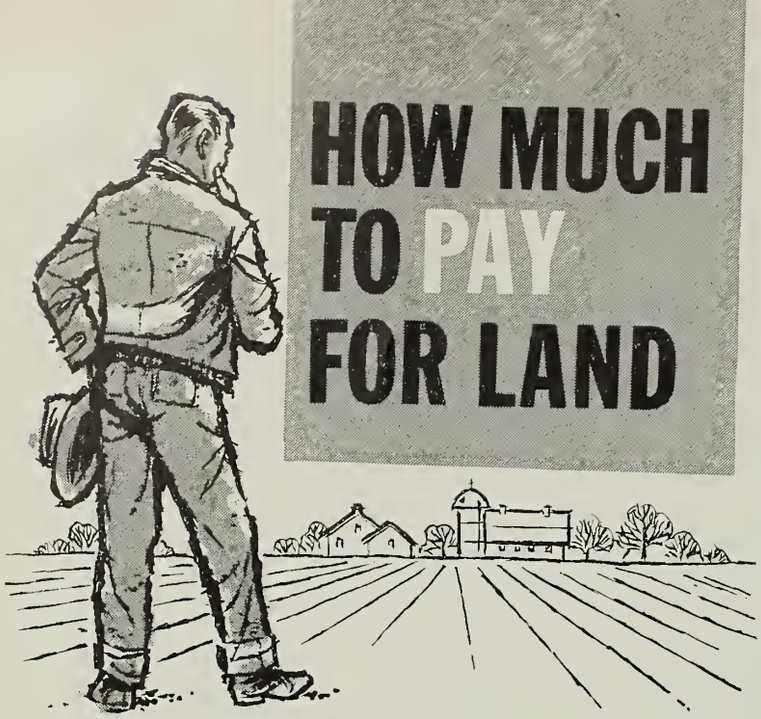
Only about 60 to 80 percent of the total lipids in flour may be extracted easily by ordinary fat solvents. Generally, this treatment does not harm the bread-baking properties of flour if shortening *is not* used; surprisingly, a slight improvement may be seen. Researchers are not yet sure what this means. The opposite effect is obtained, however, when shortening *is* used. The loaf is harder and considerably smaller. This shows that flour lipids cannot be replaced by ordinary, present-day shortening fats, and illustrates one way in which flour fats are related to the quality performance of our various flours.

The 20 to 40 percent of lipids remaining in flour after ordinary extraction seems to be chemically bound with the proteins. Removing this lipid fraction—about one-half of 1 percent of the flour—drastically reduces both loaf volume and quality. New techniques permit lipid removal without seriously affecting other flour components, as evidenced by restoration, to a large degree, of the original baking properties when the extracted lipids are added back. This suggests that lipids tightly bound to proteins are essential to normal activity of bread dough. It also justifies further consideration of these lipids as playing a very important and fundamental role in flour quality.

Lipid changeability is problem

Still another important aspect of flour lipids is that they generally change more rapidly than any other constituent in flour. Lipids often take on oxygen and change into acids. And occasionally these lipids will break down into two or more compounds due to interaction with water. Controlled oxidative changes, however, can improve baking properties. But if some of these changes go far enough, the product becomes rancid and loses in texture and flavor.

The Albany studies were initially devoted to effects of lipids on bread-baking qualities. The research is being broadened to learn their effects on the qualities of cookies and other products made of flour. ☆



Eight step formula tells you how to analyze your operations and compute the earning value of additional land that you plan to rent or buy

EIGHT MATHEMATICAL STEPS can show farmers how to answer the question: How much can I pay per acre for more land? This formula, developed by USDA researchers, will determine annual rent or purchase price.

ARS agricultural economist V. L. Hurlburt devised an analytical procedure using information from individual farm account books. If successful farming practices are followed, and if there is no over or under investing, an operator may use annual costs and returns obtained from his personal business records of income and expenditures.

Computation based on value of present farm

Value of present land and buildings must be estimated before figuring the maximum price that should be paid for additional acreage. Let's assume the farm has 190 acres used for rotation crops and 10 acres of building lots, waste, and roads, or a total of 200 acres valued at $45,000 (the market value of the property if it were sold today).

To determine actual *crop* costs and returns, crop and livestock enterprises should be separated on paper. Labor, machinery, and other costs represented in *both livestock and crop production* should be included as part of crop operations. Then these eight steps can be followed to determine what the operator can afford to spend for renting or purchasing extra land to add to his present property.

1. Add values of all crops produced during year. Pasture may be figured at hay equivalent. Let's assume the value of all crops is $12,656 for the past year.

2. Obtain average value of produce per acre. Divide the value of crops ($12,656) by the number of rotation acres (190), omitting roads, building lots, and waste. The answer ($66.61) is also the estimate of additional returns from adding one equally productive acre. Adjust for any wide difference in soil type or topography between present land and the property that is under consideration.

3. Add variable costs of crop production. Estimated cost of operator and family's labor is added, if this is not already in the accounts. Add costs of farming practices, assuming the same system is to be used regarding rotation, seeding, fertilization, cultivation, and cropping. (Fixed costs are ignored.) Let's say variable costs of the farm now being operated add up to a total of $4,360.

4. Obtain average variable cost per acre. Divide total variable costs ($4,360) by number of rotation acres (190) to find variable cost per acre ($22.95).

5. Estimate annual cost per acre of added land. Divide current market value of land and buildings ($45,000) by total number of acres (200). The answer ($225) is the market value per acre. To reduce the per-acre value to annual cost, add 1 percent to the farm-mortgage interest rate and multiply the result by market value per acre (1 percent plus 5 percent, or 6 percent, times $225 equals $13.50 annual cost per acre of land to be acquired).

6. Determine rate of return on each dollar invested. Add the cost of the land per acre ($13.50) to the variable costs per acre ($22.95). Divide this total cost ($36.45) into the average value of the product per acre ($66.61) to determine the rate of return on each dollar invested. The per-dollar rate of return in this case is $1.827.

7. Determine maximum annual rent—that is, rate of return on each additional acre. Multiply the cost of the land per acre per year ($13.50) by the dollar rate of return ($1.827). The most rent this operator can afford to pay for additional land is $24.66 per acre anually, assuming that the returns will be the same as for present operations.

8. Determine maximum purchase price per acre. Add mortgage interest rate plus another percentage for risk and divide into annual rent (5 percent plus 1 percent, or 6 percent, divide into $24.66). The answer is $411. Although the average price per acre of the farm, in this case, is $225, the operator could afford to spend as much as $411 for an additional tillable acre to add to his property.

Allowance must be made for inefficiency

A less efficient farmer would not be able to pay $411. If, for example, he had only a $13.50 rate of return on each additional acre instead of $24.66, he could not spend more than $225 per acre ($13.50 divided by 6 percent). On the other hand, if he were efficient enough to obtain $30 per acre, he could spend as much as $500 ($30 divided by 6 percent) and still break even. Thus, in eight steps prospective buyers can evaluate their prospects. ☆

PRODUCING BROILERS SEVEN WAYS

Most Delaware growers have a limited interest in the business. Dealers supply much of the working capital, take much of the risk, and share variously in the returns with growers

■ MOST OF THE BROILERS (94 percent) produced in lower Delaware in 1955 were grown under contracts with feed dealers or by the dealers themselves, according to a survey there.

This study made cooperatively by USDA and the Delaware Agricultural Experiment Station shows 66 percent of the broilers were produced under contract with feed dealers, 18 percent by contracting dealers themselves, 10 percent by noncontracting dealers who sold little or no feed. Only 6 percent of all broilers were produced by the area's independent growers.

Most growers preferred to grow broilers under contract, says ARS agricultural economist F. D. Hansing, in charge of the survey. Growers were willing to invest funds, labor, and material in houses and equipment, but few were willing to accept all risks by investing in chicks and supplies. These arrangements limited risks growers assumed. and in many instances, assured a financial return for their labor and investment.

Various plans are being used

Five different types of contracts were found in use. They were:

1. Share system: returns split on a predetermined basis of 75–25, 80–20, or ⅔–⅓, the grower receiving the larger share of the split.

2. Guarantee-share system: grower guaranteed $40 or $50 per thousand birds started and half the net return, if any, over the guarantee.

3. Flat fee: grower paid $50 to $75 per thousand birds started, regardless of prices or total return.

4. Feed conversion payments to grower based on ratio between feed used and broiler meat produced.

5. Salary or labor: grower paid a specified amount for raising broilers, sometimes as monthly salary.

Grower supplies certain things

The grower, under all these contracts, usually provided the house, equipment, and labor to raise the flock. The dealer furnished the feed, medicine, vaccine, and other necessary supplies. Dealers also arranged and paid for other items not in stock, such as chicks, fuel, and litter.

The dealer retained title until broilers were marketed, and absorbed deficits if flocks did not sell for an amount equal to the items charged against them. Some return for labor and investment was guaranteed for more than 70 percent of the broilers produced under contract.

Most contract growers had relatively small net worth and produced broilers on a small scale. Independent growers, on the average, had larger net worth and produced on a larger scale than contract growers. Apparently, as net worth and size of operation increased, more growers felt that they could afford to accept the risks of producing broilers.

Slightly more than half of the broiler growers were full-time farmers. Others were part-time, retired, and nonfarmers. Full-time farmers were more prone than others to produce independently, probably because net worth was larger. Retired persons with smallest net worth were least inclined to produce independently.

Policies and methods of lending institutions apparently were not responsible to any considerable extent for the prevalence of contracting. Terms on which small growers were financed appeared about as favorable as those extended to large growers.

The broiler industry in Delaware comprises feed manufacturers, hatcheries, processing plants, and the auction, as well as growers and retail dealers. The industry is largely self-contained. Most of the broiler feed used is manufactured locally and most broilers grown in the area are hatched and processed locally.

Feed dealer is central figure

The central figure is the feed dealer who contracts with growers. About 24 percent of these dealers also had their own feed mills and manufactured part or all of the feed they sold, and 11 percent had a financial interest in hatcheries. Thus there is a considerable measure of unified control in the production of broilers in the southern portion of Delaware. ☆

Sweating out the pests, ventilating the plant beds, and appealing to consumers are all part of the job of bringing us

that table delicacy, THE MUSHROOM

■ MUSHROOMS—NO LONGER a luxury food in this country—are adding flavor and essential vitamins to the Nation's diet. At least 85 million pounds of the delectable fungus *Agaricus campestris* are now grown and marketed each year, with a return of over $30 million at the retail stores.

Improvements in cultural methods developed through research by USDA, by State experiment stations (particularly that of Pennsylvania), and by growers have spurred development of the industry. Over the past 25 years, mushroom yields increased from about 1 pound to 2 pounds per square foot of bed space and commercial production more than doubled.

Industry is on the upgrade

Mushroom culture was once considered a sideline to market gardening. But it is now big business, capitalized at over $50 million. The industry uses specially designed growing houses and the most modern mechanical equipment. Caves and mines are also being used in large-scale production. The larger establishments commonly have lunchrooms for employees and electronic communication systems to expedite work.

Test points to further gain

Still higher yields with a better return for growers are promised by recently completed research by ARS mycologists E. B. Lambert and T. T. Ayers. It shows amount of heat and the time required to kill numerous disease organisms, insects, and other pests that attack mushrooms. Commercial growers raise the temperature of the houses to kill pests soon after beds are filled with compost. The process extends over a period of a week to 10 days, the "sweating-out period." At this time, too much heat will cause a crop failure by upsetting the nutritional balance in the compost, and too little heat will fail to kill some of the pests. We need precise knowledge.

To meet this need, Lambert and Ayers worked out the precise thermal requirement for killing the various pests. They found that all animal pests and all but one of the serious fungus pests of mushrooms can be controlled by raising temperature of the houses to between 130° and 150° F. The tests showed that length of exposure to high temperatures is an important factor in killing the pests. Also, most pests are killed more easily when moist than when dry.

The findings are based on tests made at the USDA mushroom laboratory located at Beltsville, Md., and on extensive review and analysis of data on thermal-killing-time requirement reported by USDA entomologists, by scientists of the Pennsylvania and Missouri Agricultural Experiment Stations, and by other researchers.

Aeration helps type, yield

Mushroom growers are being helped also by recent USDA research that suggests that commercial yields can be increased by ventilation in the mushroom houses. These studies show clearly that in rooms with continuous circulation of air, the mushrooms will grow normally and produce a maximum yield only when at least 5 cubic feet of fresh air is supplied per hour for every square foot of bed surface in the growing room.

Display affects the demand

In marketing experiments by the Agricultural Marketing Service and the Pennsylvania experiment station, several methods of displaying and packing mushrooms were tested for effect on sales. When pound boxes of mushrooms were added to the usual display of pint boxes, retail sales of fresh mushrooms increased yearly one-third in 12 supermarkets where the display was tried. It was also found that average sales increased when a suggestive display of pint boxes of mushrooms was placed alongside steaks in the meat case.

Although canners and processors are taking more of the mushroom crop each year, growers believe that improved merchandising by retailers could stimulate a greater demand by consumers for fresh mushrooms. These bring the highest return. ☆

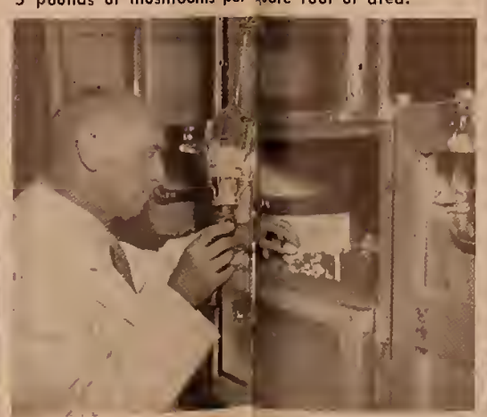
ATTRACTIVE display raised sales of mushrooms by a third in a market study by USDA in cooperation with the Pennsylvania station.

VENTILATION made this difference. Five cubic feet of fresh air hourly per square foot of bed made plants desirably stocky, but poor ventilation (lower picture) made them stemmy.

MUSHROOM houses in Pennsylvania typify structures used in commercial areas also in Delaware, Maryland, California, New York, Illinois, and elsewhere.

COMPOST bedding is now handled by labor-saving tractor power and implements for wetting and aerating. Both stable manure and synthetic compost are used.

MYCOLOGIST E. B. Lambert inspects mushroom beds in laboratory at Beltsville, Md. Beds consistently yield 5 pounds of mushrooms per square foot of area.



VENTILATING for just 8 hours followed by non-ventilation for 16 hours each day led to the growth of misshapen mushrooms (below) that consumers discriminate against in the market.

BOUNTY FROM PUERTO RICO'S HILLS

Farming system with grasses and cattle, coffee and plantains offers a good living and a new life to mountainside soils

■ PUERTO RICO CRITICALLY needs to boost its economy, and recent research findings by the Puerto Rico Agricultural Experiment Station and USDA at Rio Piedras show that expanding the island's agriculture could help.

Greatly increased production of animal products (now largely imported) and coffee (a much-needed export crop) means a sound occupation for family labor in the mountains.

Coffee, grass and cattle, and cooking-type bananas could be produced intensively on the steep mountainsides—a large and nonproductive part of the island with slopes averaging 45 percent. Much of this region of year-round growing weather and abundant rainfall is capable of returning good incomes, if used properly. Present crop-production brings low income and fosters soil erosion.

Well-managed grass, sometimes in combination with a legume, could support more dairy and beef production, both badly needed. Research on coffee at the Puerto Rico station may lead to some particularly remunerative uses for mountain land, with ground cover between rows to hold the soil. Here's the way ARS soil scientists Jose Vicente-Chandler and R. W. Pearson visualize it:

Cooperative experiments by the Puerto Rico station and the Soil Conservation Service proved that a mixture of tropical kudzu and molasses grass can be grown very profitably. This heavy-yielding mixture crowds out weeds and withstands insects. The legume kudzu produces the nitrogen needed by the plants. At little cost for lime and phosphorus fertilization, this combination yields as much as grasses receiving up to $40 worth of nitrogen per acre.

Support for one cow per acre

Planted in alternate rows 3 feet apart at Rio Piedras, this mixture soon covered the ground. Under proper grazing, it produced enough protein-rich forage per acre for year-round grazing by 1 mature cow and about 500 pounds of beef gain yearly.

The kudzu and molasses grass have another important role. Bananas and plantains (cooking bananas) are a staple in Puerto Rican diet. They are generally grown by clean culture, which in the mountains causes soil losses of up to 95 tons per acre in a year. By growing the forage between double-row contour hedges of bananas, researchers saved fertilizer, and most important, reduced the yearly soil loss to 7 tons per acre.

An extremely rank forage, Napier grass, produced 100 tons (green weight) per acre on the mountain soils in the Puerto Rico experiments. That's enough grass to feed 6 cows for

a year. The yield was obtained by fertilizing at the very high rate of 400 pounds of nitrogen per acre—$75 worth of fertilizer at farm prices.

Grazing for high-value land

This intensive production is practical only for high-value land, such as suburban dairy farms, and for places where there's only a small patch of land for support of a family cow.

Coffee would be a better source of income for about a third of this mountain agricultural land, if grown by methods developed by the Puerto Rico station and USDA. These studies showed that it's practical to grow the Bourbon variety of Arabica coffee on mountainsides ranging up to 50-percent in slope. By growing the coffee in the sunlight, fertilizing it heavily, protecting it from insects and diseases, and pruning it properly, the researchers obtained yields of 1,500 to 2,500 pounds per acre at a materials cost of only about $100 per acre.

In tests at Castaner, the Bourbon coffee yielded 600 pounds in the second year, 2,200 pounds the third year, and 2,500 pounds the fourth year. Puerto Rico now grows coffee in the shade, gives it little cultural attention, and produces only about 150 pounds of coffee per acre.

The 900,000 acres of agricultural land in the mountains could support thousands of families. It wouldn't take many acres under sound management for a prosperous grass-cattle enterprise. And the typical family of 5 could, indeed, make a satisfactory living on as little as 5 acres of the better land with coffee, intensively managed, as the main crop.

Small coffee farms favored

Family labor could properly care for 3 acres of coffee. Add one-third acre of Napier grass for 2 family cows, a garden, and the homestead. Fertilizers and other chemicals would cost $300 for the coffee and $25 to $30 for the grass. A yield of 1,500 pounds of coffee per acre and price of 40 cents per pound would return nearly $1,500 a year for labor.

This research and current experiments with new crops by the Puerto Rico station could mean a better future for the island's agriculture. ☆

NONPRODUCTIVE grass found on most of the mountain clearings is generally grazed too close. That means soil erosion (as in upper picture) and inadequate support for livestock. But kudzu—rank growing and protein rich—together with rank molasses grass on these same soils produces up to 500 pounds of beef per acre per year.

INTERPLANTING banana hedges with molasses grass and nitrogen-fixing kudzu assures good yields of a staple food item and cash income on mountain land, without attendant soil erosion.

BOURBON variety of coffee grown in full sun rather than in shade, as usual, can be productive, profitable on mountainsides.

GO-GETTER STOCK SPRAY

Now we have another chemical that gives simple and lasting control against cattle grub and screwworm

■ A NEW SYSTEMIC INSECTICIDE, Bayer 21/199, has proved highly effective as an external spray in controlling grubs in cattle and screwworms in cattle and sheep, USDA research has shown (AGR. RES., December 1956, p. 3). This chemical given orally was much less effective.

Bayer 21/199 is an organic phosphorus compound that works systemically—is absorbed through the skin, translocated to tissues containing grubs. If the spray is applied several weeks before grubs normally appear in the back, it prevents further development of the larvae. It kills screwworm larvae mostly on contact.

The sprays were tested both as emulsions and as suspensions of the chemical. The former were more effective in controlling the cattle grub, but both were equally effective treatments for the screwworm.

Against cattle grubs—larvae of the heelworm fly—the Bayer 21/199 sprays prevented grubs from appearing in the backs of most tested cattle. The only exceptions were two animals that received a low concentration of a suspension spray.

Three concentrations of the compound—0.25, 0.5, and 0.75 percent—were sprayed in November 1956 on 48 beef yearlings heavily infested with the common and northern species of grubs. Sixteen untreated animals served as checks. Spray was applied under 300 pounds pressure at an average rate of 1½ gallons per animal. It was necessary to apply large quantities under pressure to thoroughly wet the animals' thick winter coats.

Oral treatment less effective

The treatment prevented grubs from appearing in the backs of all except two animals sprayed with a 0.5 percent suspension. One had 7 grubs, the other had 1 that didn't develop.

Oral treatment with the new chemical gave some control but was abandoned because of toxicity to cattle.

Untreated cattle in both spray and oral tests averaged 44 grubs per animal. Even though use of Bayer 21/199 for cattle grub control hasn't yet been approved, ARS entomologist O. H. Graham feels that emulsion spray treatments with it are very practical (1) if applied several weeks before grubs appear in the back, and (2) if applied so as to insure adequate skin absorption.

Against the screwworm, both emulsion and suspension sprays of Bayer 21/199 were effective. Use of these sprays in controlling screwworms would be a great help to livestockmen. It would eliminate, for example, the current practice of riding the range daily hunting for infested animals and applying a smear to the wounds. (Animals are then kept in small pastures for several weeks and treated every 2 to 4 days.)

Many sheep tested successfully

Extensive trials with over 11,000 sheep on nine Texas ranches showed effectiveness of the compound against screwworm. These sheep were sprayed immediately after shearing to protect shear cuts from infestation. Another group of 408 sheep and goats was treated to prevent infestation through injuries associated with lambing, castration, docking, ear tagging, and old screwworm wounds.

Most of the sprays were suspensions prepared from a wettable powder containing 25 percent active ingredient. About 1 quart of the compound was sprayed on each sheep or goat.

In general, tests on both groups of animals had excellent results. Sprayed animals were protected from screwworm infestation for 10 to 20 days—long enough for most injuries to heal completely or to such an extent that they no longer attracted screwworms. Even where spray treatments ultimately failed, they gave 10 days' protection. (EQ–335, a lindane-based compound widely used by sheepmen to treat their sheep for screwworms, frequently failed as early as 2 to 4 days after treatment.)

Screwworm killed on contact

Bayer 21/199 kills the screwworm both upon contact and through systemic action but the systemic action lasts for only a day after spraying. Long-term effectiveness of the compound is due to the tiny particles that flake off the animals' hair into the wound, killing the worm. ☆

Heading off "Sore Head"

Rumen injections combat the tiny worms that clog the tiny blood vessels, produce large sores, and make the sheep blind and lame

A UNIQUE AND RARE disease affecting only sheep grazing on western summer ranges at high altitudes has been discovered, described, and treated by USDA scientists. The disease is filarial dermatosis, also known as elaeophoriasis or "sore head."

Filarial dermatosis of sheep is a skin malady caused by the adult worm parasite *Elaeophora schneideri.* This parasite lives in arterial blood vessels and its larvae (microfilariae) live in the skin. These microscopic larvae in the skin cause raw, bleeding lesions of the head, feet, and abdomen, resulting in blindness and lameness. The disease is most frequently found in the mountainous areas of New Mexico, Arizona, Utah, and Colorado, and occurs only above 6,000 feet. Lately, infected sheep have been reported from California, Oregon, Idaho, Montana, and Vancouver Island, British Columbia. It was first reported by ARS scientists in 1938 but had been observed by New Mexican flock owners as far back as 1932.

The worm is zoologically related to a group of nematodes producing some bizarre human and animal diseases—elephantiasis and loiasis in man, dirofilariasis or heartworm in dogs.

All early work on filarial dermatosis was done by ARS veterinarian H. E. Kemper (retired) of the Animal Disease Station, Albuquerque, N. Mex. Kemper was the first to describe the disease, learn the extent of its distribution, and develop an effective treatment. ARS parasitologist H. O. Peterson of the New Mexico laboratory, has developed even faster, cheaper, and easier remedies.

Filarial dermatosis probably isn't important on a nationwide scale. Incidence in domestic sheep is thought to be less than 1 percent, although this is hard to determine because many infested sheep are never seen or counted; owners destroy them for fear they may infect the rest of the flock. But there are indications that the disease is spreading in many areas.

Irritation causes scratching

The adult male and female worms—from 6 to 12 centimeters long—live together in some of the main arteries of the circulatory system. Lesions are thought to be produced by trapping of the microfilaria in the capillaries of the head and coronary region of the feet. In the early stages of the disease, lesions are circular and confined. As they enlarge, they become irregular.

On some sheep, lesions cover the entire side of the head, lips, nostrils, and eyes, and cause partial or total blindness. In such cases, one side of the head may become a large, raw bloody lesion. Secondary bacterial infection usually occurs. Intense ir-

BLOODY LESIONS on sheep in top photo are typical of kind found in elaeophoriasis. Same animal is shown in lower photo 20 days after treatment with Dow ET–57. Cutaneous lesions have all been completely healed.

ritation causes the sheep to scratch the sore with its hind feet or rub against some object. The result is one of the worst looking lesions in the field of animal disease. When such lesions are accompanied by blindness and lameness in at least one leg, the animal becomes an economic liability rather than an asset to the flockowner.

Treatment for the disease in the past consisted of applying various oils, unguents, salves, and powders. None was successful. In 1946, Kemper found that antimony compounds produced successful healing of lesions. Treatment generally required several successive intravenous or intramuscular injections over a period of time.

Recent research by Peterson produced faster and even more dramatic cures. He showed that complete healing of advanced cases, even those involving blindness and lameness, was entirely possible by using two equally effective compounds—Dow ET–57 and piperazine hexahydrate.

Wound can be healed entirely

A single injection of ET–57 (300 milligrams per kilogram of body weight) directly into the rumen of the affected animal cured it. Equally effective results were obtained by adding an anthelmintic containing piperazine hexahydrate to the drinking water (2 ounces per ½ gallon of water) for 3 days. Furthermore, a single treatment by drenching with 6 ounces of this anthelmintic also completely cured the condition in one sheep. Scientists believe that both drugs can be adapted to treatment under field and range conditions.

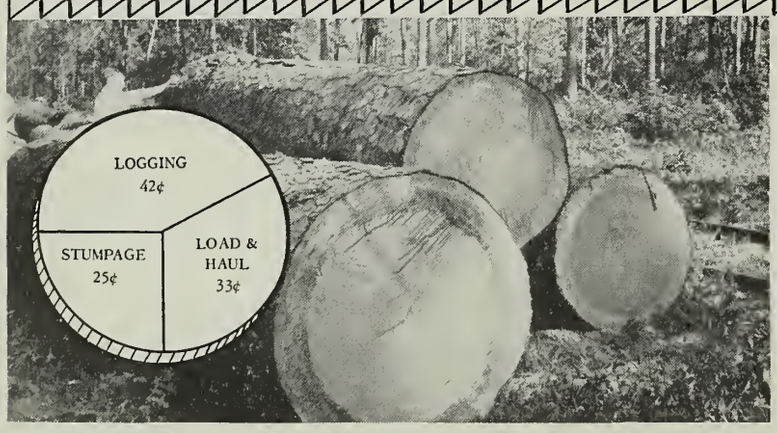
Actually, little or nothing is known about the life history of the parasite or how it is transmitted, and medicinal treatment still remains our best means of control. Most filarial parasites are transmitted by blood-sucking arthropods—mosquitoes and gnats—and this disease is probably carried in the same way.

Early work by Kemper showed that the location of lesions is an indication of the site of the adult worms in the arteries. When lesions appear on the right side of the face, for instance, the worms will probably be found in the corresponding right carotid artery or its larger branch supplying the affected region.

Deer also carry the parasite

Interesting, too, is the fact that the parasite has been found in the arteries of deer. Cutaneous lesions, though, have never been reported. These facts lead to speculation as to whether sheep acquire the parasite from deer. If so, appearance of lesions in the sheep and not in the deer indicate that the sheep is an abnormal host. ☆

CUT LARGE or CUT SMALL?



TIMBER RETURN on experimental woodlands averaged 25 percent of the market value after logging, loading, and hauling costs were calculated.

■ FARM WOODLANDS of the Southern Appalachians are being managed to determine whether small or large high-quality products are more profitable. USDA's Forest Service is conducting the study on woodland tracts at the Bent Creek Experimental Forest near Asheville, N. C.

Forty percent of the area's woodland is on farms.

Two tracts were managed for small products—small saw logs, pulpwood, and fuelwood. Two others were managed for large-high-quality products such as saw logs and veneer logs. Defective and malformed trees and low-value species were removed with farm equipment.

Cuttings in each woodland were started in 1946 and were continued each year until 1956. During the first 8 years, cuttings were made solely to improve the woodland by removing defective, over-mature trees and by thinning over-dense stands. During the last 2 years, some sound trees were also cut to increase the difference in average tree size between large-product and small-product areas. Future cuttings will be scheduled to allow growing stock to increase. Then, cuttings will be made at about the same level as annual growth. Eventually, forest researchers want to determine which type of tract will provide the greater return.

Returns from the sale of stumpage alone during the 10-year period averaged $3.55 per acre per year. This included posts, fuelwood, pulpwood, and sawtimber (timber which is usable as lumber). The study showed that if farmers had handled their own logging, they would have tripled the income to about $10 per acre per year; and if farmers had used their own trucks for loading and hauling forest products to market, the returns would have increased to nearly $15 per acre. ☆

Island will inspect meat

The Virgin Islands Government—with the help of USDA—is instituting meat inspection as part of its overall plan to improve the livestock and meat economy in the islands.

ARS's meat-inspection officials—at the request of the Virgin Islands Gov-

ernment—are advising in the organization of the program and are helping to train the personnel. Meat-inspection employees of the islands government will be getting practical work experience at the New York City meat-inspection station.

In our country, a new high has been reached in the number of meat-packing plants granted Federal meat inspection. We are now servicing 1,263 plants, an increase of more than 20 percent during the past 5 years.

Co-ops sell many turkeys

The marketing of turkeys has come a long way since the days when farmers traded the birds for other products at a general store.

The change started with pools organized to sell the turkeys for cash during the holiday season. Then, State marketing cooperatives were formed to distribute processed birds by consignment to commission firms in large cities on a year-round basis.

Today, there are in this country 30 turkey marketing cooperatives plus 1 regional organization. They handled 154 million pounds of turkey during 1956, or 16 percent of the birds sold, according to a USDA Farmer Cooperative Service survey.

Cooperatives have made important contributions to the general improvement of turkey production and marketing. They have been in the forefront in adopting improved processing and marketing methods. Cooperatives have helped growers receive equitable pay giving farmers greater incentive to produce quality birds.

Some associations also do production and related services for growers at cost, offer turkey insurance, low-cost packaging materials, transportation, and general information.

Minnesota, California, Utah, and Wisconsin marketed cooperatively the most birds in 1956. They handled a total of 104.5 million pounds, or 68 percent of the cooperative turkeys.

New uses for pine gum

License to use a USDA-patented process involving turpentine derivatives in manufacturing synthetic rubber and other important chemicals has been granted to a leading chemical manufacturer by the Secretary of Agriculture. Such uses expand markets for our southern naval stores industry.

This and another license previously granted provide for making and using the pine-gum derivatives called saturated cyclic terpene hydroperoxides. Their production and use as polymerization catalysts (agents to speed up chemical rections in industry) were developed by scientists at the Naval Stores Station of the ARS Southern Utilization Research and Development Division. Public-service patents were assigned to USDA.

The derivatives catalyze or stimulate the polymerization of certain chemicals into more complex substances through linking together of two or more molecules to form a larger molecule. The polymerizing agent does not itself enter into the end product. Synthetic rubber, the widely used polyester resins, and many other important products can be made through use of pine-gum derivatives.

The processes are available free to industrial users who apply for and obtain a license from USDA.

Potent, safe pesticides

Four new insecticides that are hard on insects but easy on man and other warm-blooded animals have been discovered by USDA chemists.

The new compounds have some interesting features. They are chemically kin to our important pesticides pyrethrum and allethrin. All are derivatives of chrysanthemumic acid, a synthetic material similar to an acid found in plants of the chrysanthemum family. And all of these chemicals have substantial lethal power over certain insects, yet a low toxicity to warm-blooded animals. But the new ones are, in fact, only an eighth as toxic to rats as pyrethrum and a third as toxic as allethrin.

The best two of the new compounds are 6-chloropiperonyl chrysanthemumate and 6-bromopiperonyl chrysanthemumate. Although slower in "knock-down," these are equal to or better than either pyrethrum or allethrin at high levels of kill against larvae of the common malarial mosquito, the codling moth, the salt marsh caterpillar, the southern armyworm,

and the body louse. They're less effective than DDT and other chlorinated hydrocarbons, all of which may leave toxic residues. (*Turn page.*)

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The chemicals were developed by ARS chemists W. F. Barthel and B. H. Alexander at the Agricultural Research Center, Beltsville, Md. Public service patents have been applied for.

The new materials are considerably more costly to make than DDT but less costly than allethrin. It's hoped that manufacture of the new ones will prove to be feasible.

Canvas pigment coatings

Pigment coatings on cotton fabrics are improving their resistance to weather and giving them a much longer life in outdoor uses.

Twenty months of experimental outdoor exposure of cotton-duck awning fabrics coated with 125 pigments showed that selected red, orange, yellow, green, blue, and white pigments made the cotton at least three times as resistant to weather deterioration. All the tests were conducted by scientists at USDA's Southern Utilization Research and Development Division, located in New Orleans, La.

Uncoated duck retains about 26 percent strength after 20 months of outdoor exposure. Of the blue pigments, indanthrene blue and iron blue provided best strength retention—73 percent. Cobalt blue and phthalocyanine blue provided the best color retention of all the blue pigments.

Of the yellow and orange pigments, molybdate orange gave outstanding strength retention—91 percent—and fair color retention. The chrome yellows and oranges gave strength retention values of 82 to 86 percent and their color retention was good. Titanium oxide was best among the white pigments with 71 percent strength retention. Of the 24 organic red and maroon pigments tested, parachlor red gave a strength retention of 83 percent; chlorinate paranitraniline, 69 percent. Both had good color retention. Most of the green pigments showed good to excellent color retention, with strength retention values ranging up to 83 percent. Iron oxides had the advantage of excellent color and strength-retention values.

Aluminum flakes provided 73 to 75

percent strength retention; copper powder and gold bronze flakes only 13 and 28 percent, respectively.

Of the 11 unclassified pigments, red lead and lead titanate gave 84 percent strength retention, dibasic phosphate, 78 percent, and litharge, 77 percent.

Inspecting plant exports

Preshipment certification of American-grown fruits, vegetables, and other produce by USDA—a service that makes for easier marketing abroad—is at an all-time high.

This inspection shows whether shipments comply with plant sanitation requirements of receiving countries. Our exporters who request this service avoid risk of expensive delays when products reach port. Tightened import restrictions in many countries have increased the demand for advanced certification of plants and plant products as apparently free from specific diseases or pests.

Some 25 million containers of domestic plants and plant products were certified for export at 52 ports in the 1957 fiscal year. They went to 123 countries. Most of the 111 commodities were fruits and vegetables.

The Colorado potato beetle, Japanese beetle, European corn borer, San Jose scale, grape phylloxera, potato wart, potato ring rot, and insects attacking tobacco and other stored products are especially dreaded by nations to whom we export.

The International Plant Protection Convention and other organizations have done much to spotlight dangers of hitchhiking pests. Safeguards taken by us before exporting could allay fears and open markets to us.

Puerto Rico certified

Puerto Rico has been declared modified-certified brucellosis free, joining nine States that have already been so certified. This means not more than 1 percent of Puerto Rico's cattle and not more than 5 percent of its herds have the brucellosis disease.

Other certified States include Connecticut, Delaware, Maine, Minnesota, New Hampshire, North Carolina, Vermont, Washington, and Wisconsin. A total of 441 counties in 27 other States have likewise been certified.

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